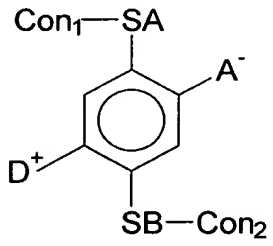
AMENDMENTS TO CLAIMS

Below is a listing of all claims presently in the application. Please amend Claims 1 and 17 as follows:

1. (currently amended) A switchable medium for a visual display comprising an electric field activated molecular system configured within an electric field generated by a pair of electrodes, said molecular system having at least one rotor portion connected to at least one stator portion, wherein said at least one rotor portion rotates with respect to said at least one stator portion between at least two different states upon application of said electric field, thereby inducing a band gap change in said molecular system, wherein in a first state, there is extended conjugation throughout said molecular system, resulting in a relatively smaller band gap, and wherein in a second state, said extended conjugation is ~~destroyed~~ changed, resulting in a relatively larger band gap.

2. (original) The switchable medium of Claim 1 wherein said molecular system has an orientation axis and wherein said rotor portion is oriented perpendicular to said orientation axis, with said external electric field applied parallel to said orientation axis.

3. (original) The switchable medium of Claim 2 wherein said molecular system comprises



Con_1 ---- Connecting Group
Con_2 ---- Connecting Group
SB ---- Stator B
SA ---- Stator A
A^- ---- Acceptor (Electron withdrawing group)
D^+ ---- Donor (Electron donating group)

where:

A^- is an Acceptor group comprising an electron-withdrawing group selected from the group consisting of: (a) hydrogen, (b) carboxylic acid and its derivatives, (c) sulfuric acid and its derivatives, (d) phosphoric acid and its derivatives, (e) nitro, (f) nitrile, (g) hetero atoms

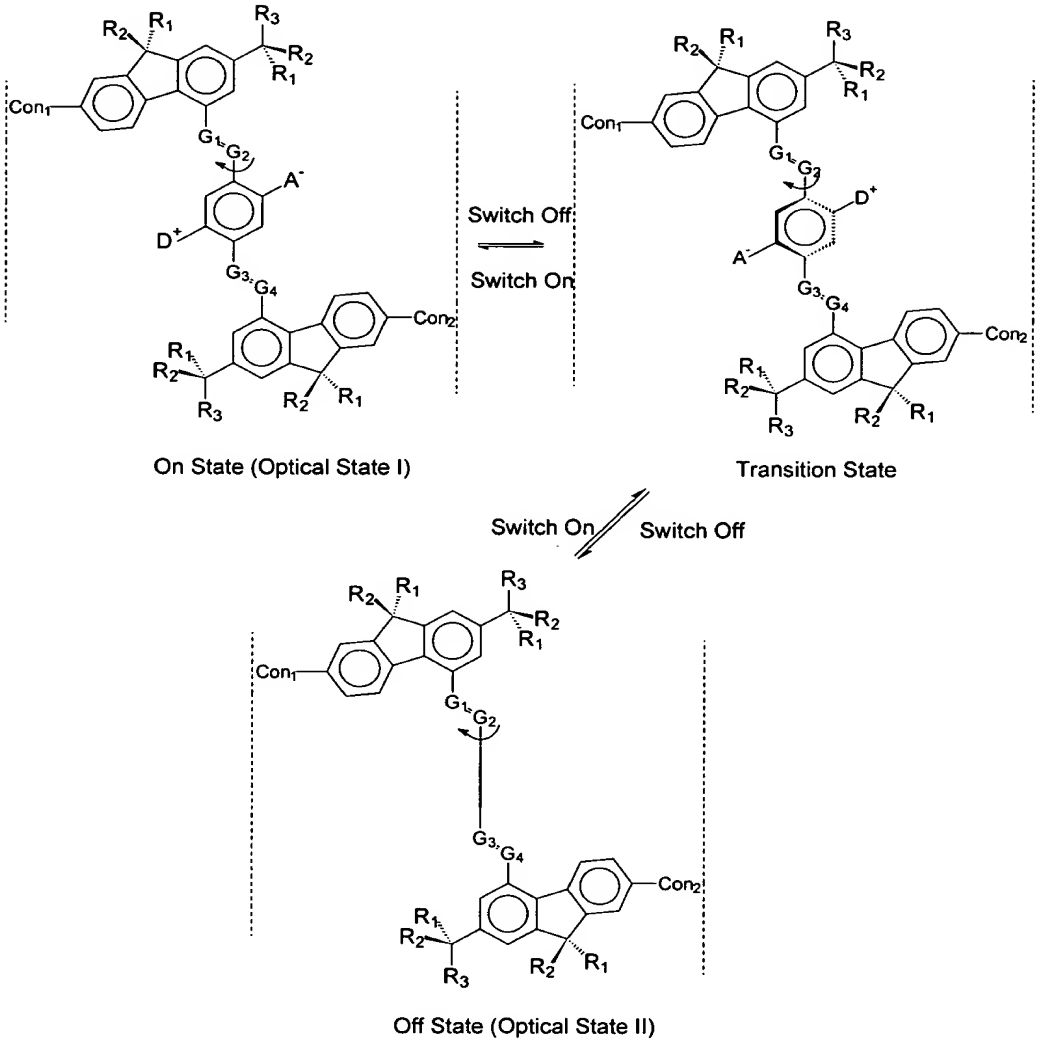
selected from the group consisting of N, O, S, P, F, Cl, Br, and I), (h) functional groups with at least one of said hetero atoms, (i) saturated or unsaturated hydrocarbons, and (j) substituted hydrocarbons;

D^+ is a Donor group comprising an electron-donating group selected from the group consisting of: (a) hydrogen, (b) amines, (c) OH, (d) SH, (e) ethers, (f) saturated or unsaturated hydrocarbons, (g) substituted hydrocarbons, and (h) functional groups with at least one hetero atom selected from the group consisting of B, Si, I, N, O, S, and P, wherein said Donor group is more electropositive than said Acceptor group;

Con_1 and Con_2 are optional connecting units between one molecule and another molecule or between a molecule and a solid substrate, said connecting units selected from the group consisting of: (a) hydrogen (utilizing a hydrogen bond), (b) multivalent hetero atoms selected from the group consisting of C, N, O, S, and P, (c) functional groups containing said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons; and

SA and SB designate Stator A and Stator B, respectively, which may be the same or different and are independently selected from the group consisting of (a) saturated or unsaturated hydrocarbons and (b) substituted hydrocarbons, wherein said hydrocarbon units contain conjugated rings that contribute to an extended conjugation of the molecule when it is in a planar state (red shifted state), wherein said stators optionally contain at least one bridging group G_n, at least one spacing group R_n, or both, wherein said at least one bridging group is either (a) selected from the group consisting of acetylene, ethylene, amide, imide, imine, and azo and is used to connect said stators to said rotor or to connect at least two conjugated rings to achieve a desired chromophore or (b) selected from the group consisting of a single atom bridge and a direct sigma bond between said rotor and said stators and wherein said at least one spacing group is selected from the group consisting of phenyl, isopropyl, and tert-butyl and is used to provide an appropriate 3-dimensional scaffolding to allow molecules to pack together while providing rotational space for each rotor to rotate over a desired range of motion.

4. (original) The switchable medium of Claim 3 wherein said molecular system comprises



where:

A^- is said Acceptor group;

D^+ is said Donor group;

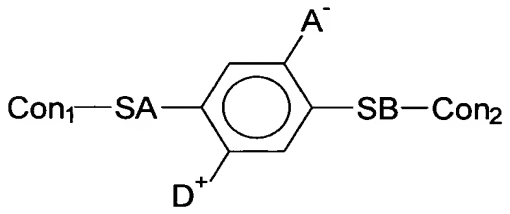
Con_1 and Con_2 are said optional connecting units;

R_1, R_2, R_3 are said spacing groups, which are independently selected from the group consisting of: (a) hydrogen, (b) saturated or unsaturated hydrocarbons, and (c) substituted hydrocarbons; and

G_1, G_2, G_3, and G_4 are said bridging groups, which are independently selected from the group consisting of: (a) hetero atoms selected from the group consisting of N, O, S, and P, (b) functional groups with at least one of said hetero atoms, (c) saturated or unsaturated hydrocarbons, and (d) substituted hydrocarbons.

5. (original) The switchable medium of Claim 1 wherein said molecular system has an orientation axis and wherein said rotor portion is oriented parallel to said orientation axis, with said external electric field applied perpendicular to said orientation axis.

6. (original) The switchable medium of Claim 5 wherein said molecular system comprises:



where:

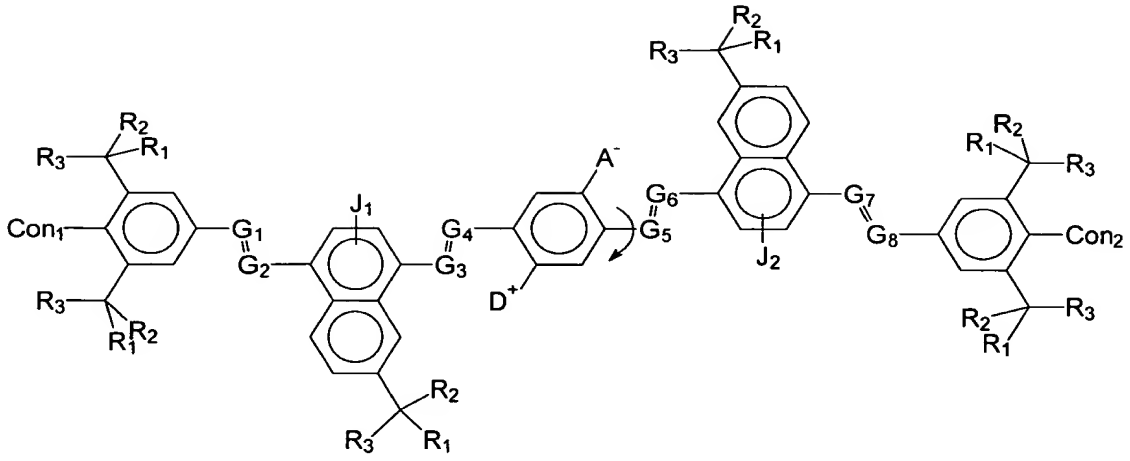
A^- is an Acceptor group comprising an electron-withdrawing group selected from the group consisting of: (a) hydrogen, (b) carboxylic acid and its derivatives, (c) sulfuric acid and its derivatives, (d) phosphoric acid and its derivatives, (e) nitro, (f) nitrile, (g) hetero atoms selected from the group consisting of N, O, S, P, F, Cl, and Br, (h) functional groups with at least one of said hetero atoms, (i) saturated or unsaturated hydrocarbons, and (j) substituted hydrocarbons;

D^+ is a Donor group comprising an electron-donating group selected from the group consisting of: (a) hydrogen, (b) amines, (c) OH, (d) SH, (e) ethers, (f) saturated or unsaturated hydrocarbon, (g) substituted hydrocarbons, and (h) functional groups with at least one hetero atom selected from the group consisting of B, Si, I, N, O, S, and P, wherein said Donor group is more electropositive than said Acceptor group;

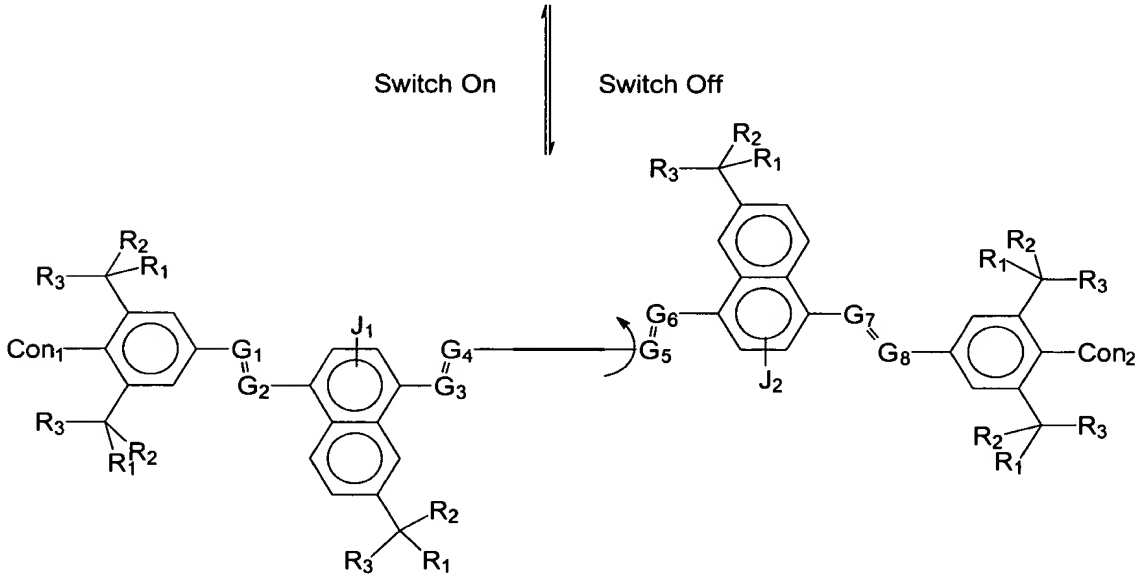
Con_1 and Con_2 are optional connecting units between one molecule and another molecule or between a molecule and a solid substrate selected from the group consisting of a metal electrode, an inorganic substrate, and an organic substrate, said connecting units independently selected from the group consisting of: (a) hydrogen (utilizing a hydrogen bond), (b) multivalent hetero atoms selected from the group consisting of C, N, O, S, and P, (c) functional groups containing said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons; and

SA and SB designate Stator A and Stator B, respectively, which may be the same or different and which are independently selected from the group consisting of (a) unsaturated or saturated hydrocarbons and (b) substituted hydrocarbons, wherein said hydrocarbon units contain conjugated rings that contribute to an extended conjugation of the molecule when it is in a planar state (red shifted state), wherein said stators optionally and separately contain at least one bridging group G_n, at least one spacing group R_n, or both, wherein said at least one bridging group is either (a) selected from the group consisting of acetylene, ethylene, amide, imide, imine, and azo and is used to connect said stators to said rotor or to connect at least two conjugated rings to achieve a desired chromophore or (b) selected from the group consisting of a single atom bridge and a direct sigma bond between said rotor and said stators and wherein said at least one spacing group is selected from the group consisting of phenyl, isopropyl, and tert-butyl and is used to provide an appropriate 3-dimensional scaffolding to allow molecules to pack together while providing rotational space for each rotor to rotate over a desired range of motion.

7. (original) The switchable medium of Claim 6 wherein said molecular system comprises:



On State (Optical State I)



Off State (Optical State II)

where:

A^- is said Acceptor group;

D^+ is said Donor group;

Con_1 and Con_2 are said optional connecting units;

R_1, R_2 and R_3 are said spacing groups, which are independently selected from the group consisting of: (a) hydrogen, (b) saturated or unsaturated hydrocarbons, and (c) substituted hydrocarbons;

G_1, G_2, G_3, G_4, G_5, G_6, G_7, and G_8 are said bridging groups, which are independently selected from the group consisting of: (a) hetero atoms selected from the group consisting of N, O, S, and P, (b) functional groups with at least one of said hetero atoms, (c) saturated or unsaturated hydrocarbons, and (d) substituted hydrocarbons; and

J_1 and J_2 are tuning groups to provide at least one appropriate functional effect selected from the group consisting of inductive effects, resonance effects, and steric effects, said tuning groups being selected from the group consisting of: (a) hydrogen, (b) hetero atoms selected from the group consisting of N, O, S, P, B, F, Cl, Br and I, (c) functional groups with at least one of said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons.

8. (previously presented) The switchable medium of Claim 1 wherein said molecular system is bi-stable.

9. (original) The switchable medium of Claim 1 wherein said molecular system has essentially a low activation barrier between different states to provide a fast, but volatile, switch.

10. (original) The switchable medium of Claim 1 wherein said molecular system has more than two switchable states, such that optical properties of said molecular system can be tuned by either continuously by application of a decreasing or increasing electric field to form a volatile switch or the color is changed abruptly by the application of voltage pulses to a switch with at least one activation barrier.

11. (original) The switchable medium of Claim 1 wherein said molecular system changes between a transparent state and a colored state.

12. (original) The switchable medium of Claim 1 wherein said molecular system changes between one colored state and another colored state.

13. (original) The switchable medium of Claim 1 wherein said molecular system comprises one rotor and one stator.

14. (original) The switchable medium of Claim 1 wherein said molecular system comprises at least two rotors, each connected to one stator.

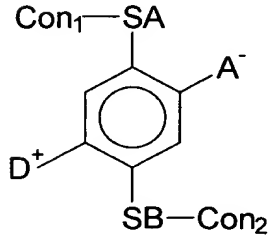
15. (original) The switchable medium of Claim 1 wherein said molecular system comprises one rotor, connected between two stators.

16. (original) The switchable medium of Claim 1 wherein said molecular system comprises alternating rotors and stators.

17. (currently amended) An electronic ink including an electric field activated molecular system configured within an electric field generated by a pair of electrodes, said molecular system having at least one rotor portion connected to at least one stator portion, wherein said at least one rotor portion rotates with respect to said at least one stator portion between at least two different states upon application of said electric field, thereby inducing a color change in said molecular system, wherein in a first state, there is extended conjugation throughout said molecular system, resulting in a first color state, and wherein in a second state, said extended conjugation is ~~destroyed~~ changed, resulting in either a transparent state or a second color state.

18. (original) The electronic ink of Claim 17 wherein said molecular system has an orientation axis and wherein said rotor portion is oriented perpendicular to said orientation axis, with said external electric field applied parallel to said orientation axis.

19. (original) The electronic ink of Claim 18 wherein said molecular system comprises



Con_1 ---- Connecting Group
Con_2 ---- Connecting Group
SB ---- Stator B
SA ---- Stator A
A^- ---- Acceptor (Electron withdrawing group)
D^+ ---- Donor (Electron donating group)

where:

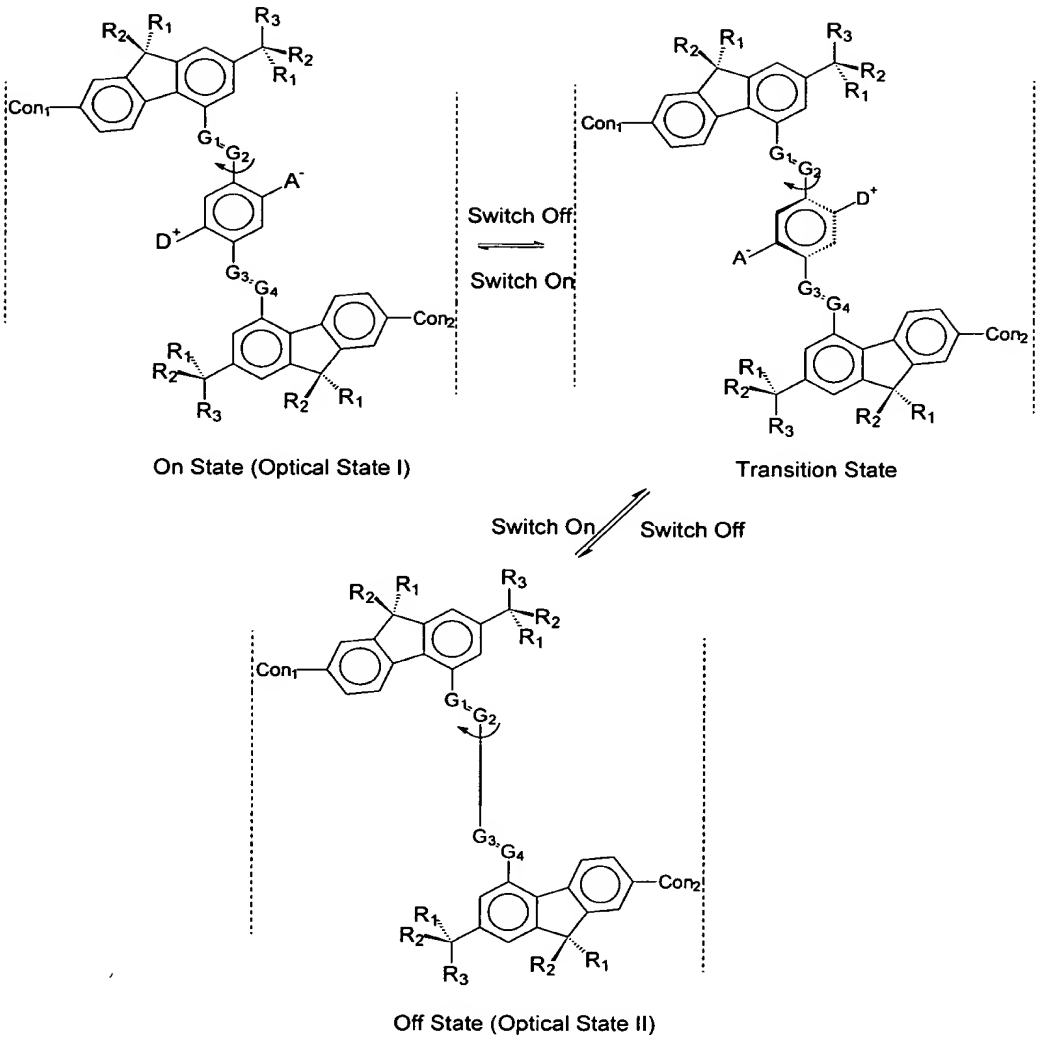
A^- is an Acceptor group comprising an electron-withdrawing group selected from the group consisting of: (a) hydrogen, (b) carboxylic acid and its derivatives, (c) sulfuric acid and its derivatives, (d) phosphoric acid and its derivatives, (e) nitro, (f) nitrile, (g) hetero atoms selected from the group consisting of N, O, S, P, F, Cl, Br, and I), (h) functional groups with at least one of said hetero atoms, (i) saturated or unsaturated hydrocarbons, and (j) substituted hydrocarbons;

D^+ is a Donor group comprising an electron-donating group selected from the group consisting of: (a) hydrogen, (b) amines, (c) OH, (d) SH, (e) ethers, (f) saturated or unsaturated hydrocarbons, (g) substituted hydrocarbons, and (h) functional groups with at least one hetero atom selected from the group consisting of B, Si, I, N, O, S, and P, wherein said Donor group is more electropositive than said Acceptor group;

Con_1 and Con_2 are optional connecting units between one molecule and another molecule or between a molecule and a solid substrate, said connecting units selected from the group consisting of: (a) hydrogen (utilizing a hydrogen bond), (b) multivalent hetero atoms selected from the group consisting of C, N, O, S, and P, (c) functional groups containing said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons; and

SA and SB designate Stator A and Stator B, respectively, which may be the same or different and are independently selected from the group consisting of (a) saturated or unsaturated hydrocarbons and (b) substituted hydrocarbons, wherein said hydrocarbon units contain conjugated rings that contribute to an extended conjugation of the molecule when it is in a planar state (red shifted state), wherein said stators optionally contain at least one bridging group G_n, at least one spacing group R_n, or both, wherein said at least one bridging group is either (a) selected from the group consisting of acetylene, ethylene, amide, imide, imine, and azo and is used to connect said stators to said rotor or to connect at least two conjugated rings to achieve a desired chromophore or (b) selected from the group consisting of a single atom bridge and a direct sigma bond between said rotor and said stators and wherein said at least one spacing group is selected from the group consisting of phenyl, isopropyl, and tert-butyl and is used to provide an appropriate 3-dimensional scaffolding to allow molecules to pack together while providing rotational space for each rotor to rotate over a desired range of motion.

20. (original) The electronic ink of Claim 19 wherein said molecular system comprises



where:

A^- is said Acceptor group;

D^+ is said Donor group;

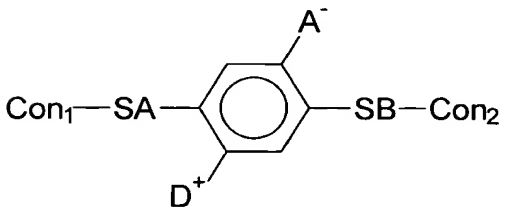
Con_1 and Con_2 are said optional connecting units;

R_1, R_2, R_3 are said spacing groups, which are independently selected from the group consisting of: (a) hydrogen, (b) saturated or unsaturated hydrocarbons, and (c) substituted hydrocarbons; and

G_1, G_2, G_3, and G_4 are said bridging groups, which are independently selected from the group consisting of: (a) hetero atoms selected from the group consisting of N, O, S, and P, (b) functional groups with at least one of said hetero atoms, (c) saturated or unsaturated hydrocarbons, and (d) substituted hydrocarbons.

21. (original) The electronic ink of Claim 17 wherein said molecular system has an orientation axis and wherein said rotor portion is oriented parallel to said orientation axis, with said external electric field applied perpendicular to said orientation axis.

22. (original) The electronic ink of Claim 21 wherein said molecular system comprises:



where:

A^- is an Acceptor group comprising an electron-withdrawing group selected from the group consisting of: (a) hydrogen, (b) carboxylic acid and its derivatives, (c) sulfuric acid and its derivatives, (d) phosphoric acid and its derivatives, (e) nitro, (f) nitrile, (g) hetero atoms selected from the group consisting of N, O, S, P, F, Cl, and Br, (h) functional groups with at least one of said hetero atoms, (i) saturated or unsaturated hydrocarbons, and (j) substituted hydrocarbons;

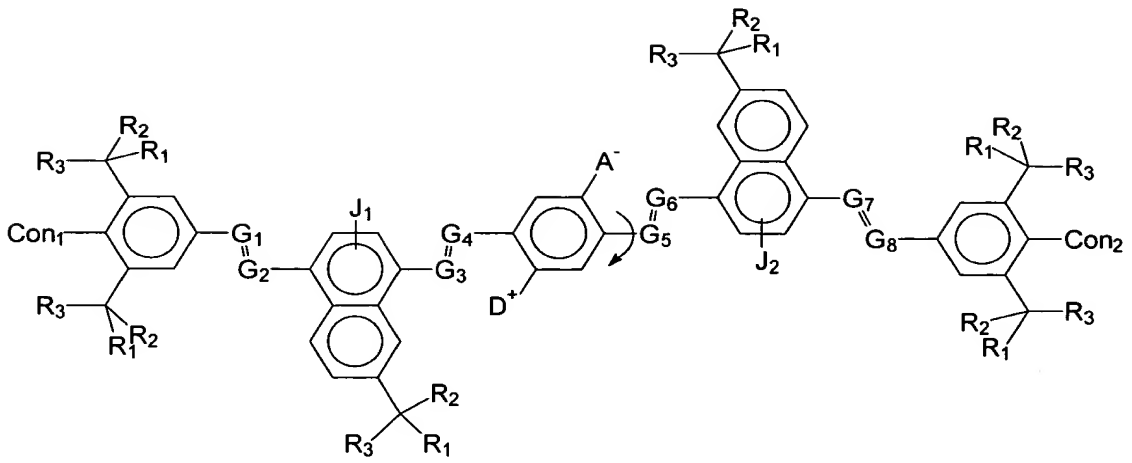
D^+ is a Donor group comprising an electron-donating group selected from the group consisting of: (a) hydrogen, (b) amines, (c) OH, (d) SH, (e) ethers, (f) saturated or unsaturated hydrocarbon, (g) substituted hydrocarbons, and (h) functional groups with at least one hetero atom selected from the group consisting of B, Si, I, N, O, S, and P, wherein said Donor group is more electropositive than said Acceptor group;

Con_1 and Con_2 are optional connecting units between one molecule and another molecule or between a molecule and a solid substrate, said connecting units independently selected from the group consisting of: (a) hydrogen (utilizing a hydrogen bond), (b) multivalent hetero atoms selected from the group consisting of C, N, O, S, and P, (c) functional groups containing said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons; and

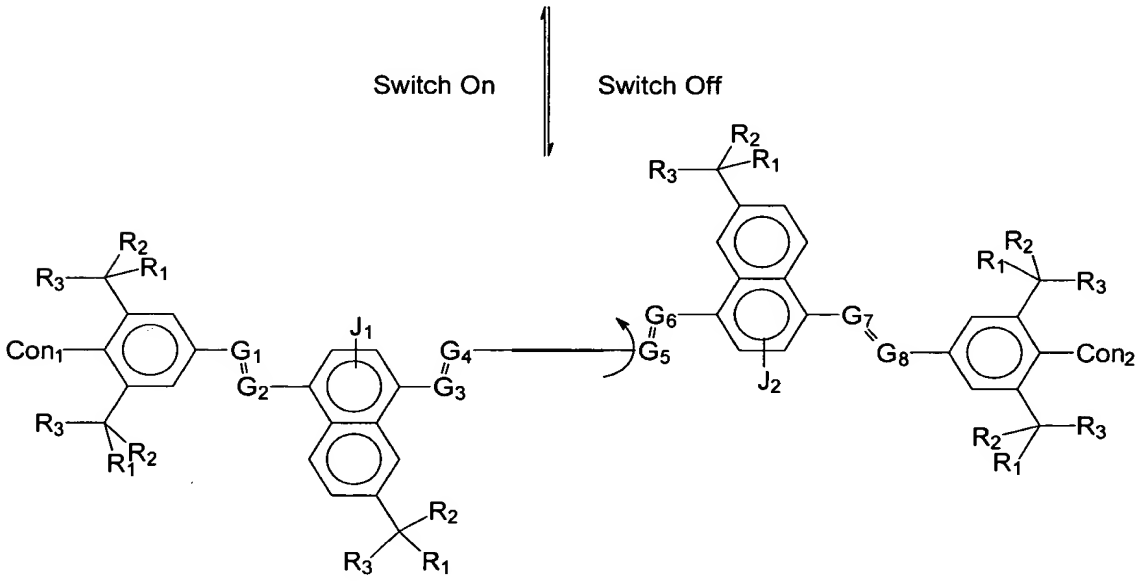
SA and SB designate Stator A and Stator B, respectively, which may be the same or different and which are independently selected from the group consisting of (a) unsaturated or saturated hydrocarbons and (b) substituted hydrocarbons, wherein said hydrocarbon units

contain conjugated rings that contribute to an extended conjugation of the molecule when it is in a planar state (red shifted state), wherein said stators optionally and separately contain at least one bridging group G_n, at least one spacing group R_n, or both, wherein said at least one bridging group is either (a) selected from the group consisting of acetylene, ethylene, amide, imide, imine, and azo and is used to connect said stators to said rotor or to connect at least two conjugated rings to achieve a desired chromophore or (b) selected from the group consisting of a single atom bridge and a direct sigma bond between said rotor and said stators and wherein said at least one spacing group is selected from the group consisting of phenyl, isopropyl, and tert-butyl and is used to provide an appropriate 3-dimensional scaffolding to allow molecules to pack together while providing rotational space for each rotor to rotate over a desired range of motion.

23. (original) The electronic ink of Claim 22 wherein said molecular system comprises:



On State (Optical State I)



Off State (Optical State II)

where:

A^- is said Acceptor group;

D^+ is said Donor group;

Con_1 and Con_2 are said optional connecting units;

R_1, R_2 and R_3 are said spacing groups, which are independently selected from the group consisting of: (a) hydrogen, (b) saturated or unsaturated hydrocarbons, and (c) substituted hydrocarbons;

G_1, G_2, G_3, G_4, G_5, G_6, G_7, and G_8 are said bridging groups, which are independently selected from the group consisting of: (a) hetero atoms selected from the group consisting of N, O, S, and P, (b) functional groups with at least one of said hetero atoms, (c) saturated or unsaturated hydrocarbons, and (d) substituted hydrocarbons; and

J_1 and J_2 are tuning groups to provide at least one appropriate functional effect selected from the group consisting of inductive effects, resonance effects, and steric effects, said tuning groups being selected from the group consisting of: (a) hydrogen, (b) hetero atoms selected from the group consisting of N, O, S, P, B, F, Cl, Br and I, (c) functional groups with at least one of said hetero atoms, (d) saturated or unsaturated hydrocarbons, and (e) substituted hydrocarbons.

24. (previously presented) The electronic ink of Claim 17 wherein said molecular system is bi-stable.

25. (original) The electronic ink of Claim 17 wherein said molecular system has essentially a low activation barrier between different states to provide a fast, but volatile, switch.

26. (original) The electronic ink of Claim 17 wherein said molecular system has more than two switchable states, such that optical properties of said molecular system can be tuned by either continuously by application of a decreasing or increasing electric field to form a volatile switch or the color is changed abruptly by the application of voltage pulses to a switch with at least one activation barrier.

27. (original) The electronic ink of Claim 17 wherein said molecular system changes between a transparent state and a colored state.

28. (original) The electronic ink of Claim 17 wherein said molecular system changes between one colored state and another colored state.

29. (original) The electronic ink of Claim 17 wherein said molecular system comprises one rotor and one stator.

30. (original) The electronic ink of Claim 17 wherein said molecular system comprises at least two rotors, each connected to one stator.

31. (original) The electronic ink of Claim 17 wherein said molecular system comprises one rotor, connected between two stators.

32. (original) The electronic ink of Claim 17 wherein said molecular system comprises alternating rotors and stators.